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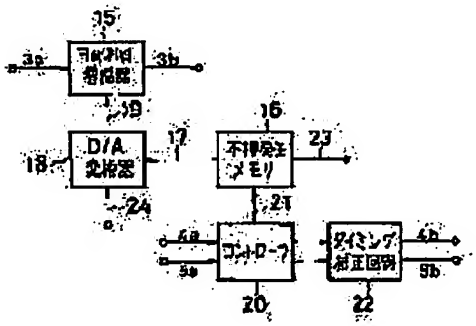
(54) METHOD AND DEVICE FOR CORRECTING PICTURE INFORMATION

(57)Abstract:
PURPOSE: To realize a correcting device which is capable of reproducing a picture having an excellent uniformity even when a light source with uniformity, is used copes with the revision of a model, relieves the deterioration in the yield of a panel having uneven brightness and contributes to the manufacture cost reduction.
CONSTITUTION: A variable gain amplifier 15 is provided on a path through which the brightness or the chromaticity or the signal component of both of a picture display device is supplied, and a each optimum correction value is stored to a memory 16 corresponding to the display position of a picture element displayed on the picture display device. The correction value is read from the memory 16 and the signal component in the variable gain amplifier 15 is sequentially controlled to control a transmission light based on the correction value corresponding to the display position.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The compensator of the image display device characterized by to have the signal conditioning means formed in the path which supplies the signal component of the brightness of an image display device, a chromaticity, or both, a storage means for recording each optimal correction value corresponding to the display position of the pixel displayed on said image display device, and the control means which reads correction value from said storage means, and controls sequentially the signal component in said signal conditioning means with the correction value corresponding to said display position.
[Claim 2] Said signal conditioning means is the compensator of the image information given in the 1st term of a claim characterized by having a means to multiply by it and control the optimal multiplier for at least one side of said signal component, or both each by the value which adjusted the alternating current amplitude of said signal component, direct current level, or its both directly based on said correction value, or corrected said correction value serially according to at least the alternating current amplitude of an input signal, one side of direct current level, or both value. The compensator of the image information according to claim 1 by which it is characterized.

[Claim 3] Said signal conditioning means is the compensator of the image information according to claim 1 characterized by being prepared in the path which supplies the signal component of the brightness of said image display device, a chromaticity, or both removable.
[Claim 4] The amendment approach of the image display device characterized by forming a signal conditioning means in the path which supplies the signal component of the brightness of an image display device, a chromaticity, or both, recording each optimal correction value on the storage means corresponding to the display position of the pixel displayed on said image display device, reading correction value from said storage means, and controlling sequentially the signal component in said signal conditioning means with the correction value corresponding to said display position.
[Claim 5] Said signal-conditioning means is the amendment approach of the image information given in the 4th term of a claim characterized by having a means to multiply by it and control the optimal multiplier for at least one side of said signal component, or both each by the value which adjusted the alternating current amplitude of said signal component, direct current level, or its both directly based on said correction value, or corrected said correction value serially according to at least the alternating current amplitude of an input signal, one side of direct current level, or both value.
[Claim 6] Said amendment data are the amendment approach of the image information according to claim 4 characterized by to be amendment data created based on the property data of the image display device measured beforehand in the condition do not amend, to be amendment data containing additional data unrelated to said amendment data, or to be data completely unrelated to said amendment data, and to be data which each data is used fixed independently, or are switched and used for arbitration.
[Claim 7] It is the amendment approach of the image information according to claim 4 characterized by for said amendment data to be numeric data which had fixed relation with the deflection from the numeric data which had fixed relation with use or the direct current level of said signal-conditioning means, or the standard gain set up beforehand, or the deflection from criteria direct current level, and for the address of the memory which memorizes these data to have the location and the correspondence relation of the pixel to display.
[Claim 8] The numeric data in which said amendment data had fixed relation with the gain of said signal conditioning means, or direct current level, Or the numeric data which had fixed relation with the deflection from the standard gain set up beforehand, or the deflection from criteria direct current level, Or the numeric data which had fixed relation with the rate of change of gain or direct current level, Or the positional information of the point that the rate of change of the deflection from the standard gain set up beforehand or criteria direct current level, the numeric data which had fixed relation, and this numeric data change, Or it is the

amendment approach of the image information according to claim 4 characterized by being data with which the information showing the number of pixels by which the same numeric data is repeated became a lot, and there being no address of the memory which memorizes these data in the location and correspondence relation of the pixel to display.
[Claim 9] It is the amendment approach of the image information according to claim 4 characterized by for said amendment data be code data change of the deflection from the gain of said signal conditioning means , change of direct current level , the standard gain set up beforehand , or criteria direct current level indicates it to be that they are an increment or reduction , and the address of the memory which memorizes these data have the location and correspondence relation of the pixel to display .
[Claim 10] it be the amendment approach of the image information according to claim 1 characterize by for said amendment data to be the data with which the code data which show that change of the deflection from the gain of said signal conditioning means , change of direct current level , the standard gain set up beforehand , or criteria direct current level be an increment or reduction , and the information showing the number of pixels by which the same sign be repeat became a lot , and for there to be no address of the memory which memorize this data in the location and the correspondence relation of the pixel display .

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention specifically sets compensation of partial degradation of the image by brightness unevenness, such as a liquid crystal panel (Following LCDP and brief sketch) currently used for the DEREBIJON receiving set etc., etc. as the main purposes about the amendment approach of the image information of an image display device, and equipment.
[0002]
[Description of the Prior Art] LCDP began to be used instead of the Braun tube with which the image display device used for the television receiver etc. in recent years has been used from the former. LCDP has the advantage that depth of a device can be made small compared with the Braun tube, and is leading equipment for image display. The characteristic point of LCDP is not emitting light oneself, and it is common knowledge that there are a light transmission form and a reflex as a display format. As a general application, the light source is established behind LCDP and the transparency form which controls the amount of transmitted lights by LCDP is used. In order to obtain the image of uniform brightness over the whole screen, it must be uniform, and this light source is made to deform the thickness of the lamp for the light sources, and the diffusion plate formed between LCDP(s) according to the location of a lamp, or elaborates the configuration of a reflecting plate established behind the lamp for the light sources, and the efforts for for acquiring the uniform light source are made.
[0003]
[Problem(s) to be Solved by the Invention] It is one technical problem that the image display device using LCDP acquires the light source of uniform brightness over the whole screen on the structure. In order to acquire the light source of uniform brightness, this problem increases whenever [difficult] as spacing of a light source lamp and LCDP must be secured enough, and thin shape-ization of the display which is the advantage of LCDP cannot fully demonstrate that effectiveness, either, especially the size of a screen large-sized-izes. Moreover, since a diffusion plate and a reflecting plate have a light source lamp and a close relation, when it is going to change the class of lamp or is going to change a screen size, they are changed into coincidence and have the problem that ****** is not made as for flexible correspondence to ** and model modification. The problem on manufacture of the LCDP itself is also one of another causes of brightness unevenness further again. That is, the brightness of the display screen is determined with the permeability of LCDP, and this permeability is influenced by the thickness of the glass plate holding liquid crystal, and its spacing. In further for color displays, change of local transparency of a color filter is detected as brightness unevenness. Since a location changes with one-sheet one panels, in the Prior art, the brightness unevenness resulting from these LCDP(s) cannot cope with it, but is processed as a defective article, and has become the factor which reduces the yield of a panel as a result.
[0004] Then, the image which had good homogeneity even if the purpose of this invention was comparatively easy and it used the heterogeneous light source is reproducible. the difficult problem for acquiring the above-mentioned uniform light source in manufacturing an image display device -- avoiding — model modification, while being able to respond flexibly The fall of the yield of a panel with the brightness unevenness which was not able to be used as a defective article is relieved conventionally, and it is in realizing the compensator synthetically contributed to the manufacture cost reduction of a panel.
[0005]
[Means for Solving the Problem] The means for equalization carried out from the former was a means for making into homogeneity the light source which carries out incidence to LCDP. This invention avoids the various difficulties which are not the incident light of LCDP and are generated by the conventional approach by equalizing the transmitted light paying attention to the function of LCDP. That is, with a means to add the signal

for amendment to the electrical signal supplied to LCDP in addition to the diffusion plate and reflecting plate which have been used from the former, if it sees as the whole image display device even if imperfect as the light source, the image of uniform brightness will be displayed.
[0006]
[Function] As for LCDP, the permeability changes with electric signals. Where the uniform light source is irradiated at LCDP, if a video signal is impressed to LCDP, the image according to a video signal will be observed as the transmitted light of LCDP. Conversely, if an electric signal is given so that the heterogeneity of the light source may be negated even if it irradiates the uneven light source at LCDP, brightness uniform as the transmitted light of LCDP can be obtained. Therefore, the uneven light source is irradiated at LCDP, and if the signal which negates the heterogeneity of the light source to LCDP, and a video signal are impressed in piles, the image of uniform brightness will be reproduced.
[0007]
[Example] Hereafter, the example of this invention is explained with reference to a drawing. The liquid crystal television of monochrome form where the usual television broadcasting of explanation is received as an image display device is made into the example for convenience.
[0008] Drawing 1 is the block diagram of the liquid crystal television of monochrome form which applied this invention. For simplification, all of an antenna required for the usual broadcast reception, channel selection equipment, a signal processor, etc. shall be contained in the receive section 1, and explanation is omitted. A video signal 3, a horizontal driving signal 4, a vertical driving signal 4, and a vertical driving signal 5 are supplied to the image display section 6 through the image amendment section 2 of this invention, respectively from a receive section 1. The suffix of b is attached and distinguished to the signal outputted to the signal inputted into the expedient upper image amendment section 2 of explanation in the suffix of a. The image display section 6 explains the conventional liquid crystal display and the unusual point briefly for an understanding of actuation of this invention, although there is nothing. Explanation of the principle of operation itself is omitted.
[0009] Drawing 2 is the detail block of the image display section 6. The liquid crystal panel 7 assumes the TFT active-matrix method of a spread form, and makes the vertical number of effective pixels level, and 320 and the thing which is 240, respectively. Therefore, in this example, the usual interlace is not performed but a screen is rewritten for every field. LCDP of drawing 2 is drawing customarily seen from the flesh side of the screen, and if it displays as a coordinate which makes the location of the pixel explained later, and the upper right of drawing a zero (0 0) (level, perpendicular), the lower left of drawing is expressed as (319,239). The X electrode 8 and the Y electrode 9 which drive each pixel are pulled out by the upper and lower sides and right and left at intervals of a pixel in order to mitigate the process tolerance of a panel. 2 sets of X drivers 10 and 11 which have 160 steps of shift registers respectively are connected to X electrode, and 120 steps of Y drivers 12 and 13 are respectively connected to Y electrode. A level clock, an auxiliary signal and a perpendicular clock, and an auxiliary signal are supplied to X and Y driver from a controller 14, respectively. The controller 14 has generated the horizontal and the perpendicular clock synchronizing with the horizontal and vertical driving signal which are supplied through the image amendment section 2. Supply is carried out for the video signal to X driver through the image amendment section 2. The sampling circuit is established in the video-signal input section of X driver (not shown), a video signal is sampled for every level clock period, and it transmits to the latter part one by one for every level clock period by the shift register, and is written in a panel all at once for every horizontal blanking interval. A vertical scan is controlled by the perpendicular clock supplied to Y driver from a controller 14, and a signal is impressed to the pixel electrode of the location where the electrode respectively driven with X driver and Y driver crosses. There is another common electrode (not shown) in LCDP, the permeability of liquid crystal changes according to the potential difference of a common electrode and a pixel electrode, and an image is displayed. The relation between the display position of a pixel and a television signal is determined uniquely as follows.
[0010] It is what was made to contrast the relation of a driving signal and a pixel horizontal [drawing 3] and vertical, and was drawn, and an axis of abscissa makes one period of a level clock correspond to 1 pixel, and shows 1 level period, and an axis of ordinate makes one period of a horizontal driving signal correspond to one line, and shows 1 perpendicular period. Since the number of pixels of the perpendicular direction of LCDP was set to 240, 90% (240/262.5) of private contracts of the signal of the 1 field is displayed on a screen. Supposing it displays 90% horizontally similarly, 356 will be chosen as an integer near 320/0.9, and 356 level clocks per 1 level period are needed. If count from the beginning of a vertical driving signal, and make the 20th horizontal scanning line into the 0th line of LCDP, it counts from the beginning of a horizontal driving signal horizontally in consideration of the bright-line blanking time before and after a horizontal and vertical driving signal, the 32nd clock is made into the 0th pixel and it counts at a line counter and a clock counter respectively, the location displayed on a screen can be directly directed with the value of a counter. However, in fact, since X and Y

driver are used by 2 sets, each driver is driven by turns at one half of the speed of the upper clock.
[0011] Drawing 4 is the theoretic block diagram of the image amendment section 2. After the video signal supplied from a receive section receives gain control with a variable gain amplifier 15, it is outputted. The gain of a variable gain amplifier 15 is controlled by the control voltage 19 from which the data 17 read from the nonvolatile memory 16 which has memorized the data corresponding to the gain which it is going to set up beforehand were changed by D/A converter 18. The value corresponding to an image display location is read by the horizontal driving signal 4 with which the data of memory 16 are supplied from the image amendment section 2, and the address control signal 21 generated by the controller 20 on the basis of a vertical driving signal 5. A horizontal driving signal 4 and a vertical driving signal 5 are supplied to the image display section 6 through the timing amendment circuit 22, respectively. Moreover, two or more data input terminals 23 and 24 for the below-mentioned initial setting are formed in memory 16 and D/A converter 18.
[0012] Although an address control signal is generated from a horizontal and a perpendicular signal by this example, it is easy to be the same as the horizontal of LCDP, and the value of a perpendicular counter fundamentally, and when a signal can be taken out from the horizontal and perpendicular counter of a panel, a circuit can be simplified sharply. The address of memory 16 can be expressed with the same notation as the location of the pixel explained by drawing 3 , and read-out is performed as it is with said Rhine and a clock counter value. Since the numbers of pixels of X and the direction of Y are 320 and 240, respectively, X can be expressed with 9 bits and Y can be expressed with the binary number of 8 bits. Suppose that the locations of a pixel are (285, 137) as an example. If the hexadecimal notation of 285 and 137 is carried out, since it is $11D and $89, the address of memory will be specified like $11D89, respectively. (Since a horizontal scanning period is expressed in television relation as H in many cases, in order to avoid derangement, a hexadecimal notation attaches and expresses $ also to the following explanation before a figure) .
[0013] The data of memory 16 are memorized for the numeric value of 1 byte (8 bits) about the one address. the min of 8-bit D/A converter 18 -- resolving power is 0.005V, and when the data of memory change from $00 to $FF, the control voltage of a variable gain amplifier 15 changes to 1.275V from 0V. The relation between the gain of a variable gain amplifier 15 and control voltage is set up proportionally [straight-line] by this example. When control voltage is 0V and gain 0 and control voltage are maxes, 1.275V [i.e.,], it is twice, and when control voltage is 0.64V (i.e., when the data of memory are $80), gain increases 1 time.
[0014] Next, the procedure which actually amends brightness unevenness is explained. Drawing 5 is the conceptual diagram of the equipment for initializing the image amendment section 2 of this invention. Initial setting is performed in the condition of having included in the TV except the receive section 1 of drawing 1 . In drawing, the light source lamp 25, the reflecting plate 26, and the diffusion plate 27 are assembled by LCDP6 at normal. Equipment required for initial setting is the collection lens 28 of light, an optical/electrical converter 29, and a controller 30, and although not shown in drawing, a condenser lens and an optical/electrical converter 29 are united, and are fixed to LCDP and a fixed location, and the whole is shaded so that the light from the outside may not leak to an optical/electrical converter 29. A controller 30 is equipped with the A/D converter which inputs the output signal from an optical/electrical converter 29, and is changed into a digital signal, outputs the signal for initial setting to the image amendment section 2, and can constitute it from a common personal computer easily while it outputs the horizontal and vertical driving signal which drive LCDP. If the fixed signal of halftone ready brightness is inputted as a video signal and the amount of transmitted lights of LCDP is sampled for every pixel with such a configuration, distribution of brightness unevenness as shown in drawing 6 A will be acquired. At this time, a control signal 24 is impressed to D/A converter 18 from the outside, and it is set up so that the gain of a variable gain amplifier 15 may be set to 1 regardless of the data read from memory 16. What 6 Fig. B made the axis of abscissa permeability about the one scanning line in the location of a pixel, and normalized the axis of ordinate on the basis of the average transmission coefficient of the whole screen is shown. As this normalization permeability becomes uniform on the whole screen, it amends brightness unevenness. That is, the part with low transmission enlarges luminance-signal level, and the part with high transmission makes luminance-signal level small. If a concrete numeric value shows, since it is not necessary to amend, gain is 1, amendment data are $80, and since permeability needs to lower 20% from an average, amendment data will become 80% of $80, $66 [i.e.,], in the place where permeability is equal to the average value of the whole screen. Drawing 6 C is an amendment curve obtained by taking the inverse number of the curve of B based on this idea. Although this example assumed the gain of a variable gain amplifier, and the relation of control voltage to be straight lines, realizing a perfect straight line in fact should just add amendment beforehand, when it is not necessary to make it a straight line that it is difficult and by force [again] and an amendment curve is calculated from the measured value of transmission. If the program is beforehand included in the controller, count of this amendment curve will be immediately called for at the same time it takes data. In this way, the obtained correction data are written in memory 16 through the data input line 23 from a controller,

and initial setting is ended.
[0015] As explained above, as for LCDP, according to this example, that permeability changes with electric signals. Where the uniform light source is irradiated at LCDP, if a video signal is impressed to LCDP, the image according to a video signal will be observed as the transmitted light of LCDP. Conversely, if an electric signal is given so that the heterogeneity of the light source may be negated even if it irradiates the uneven light source at LCDP, brightness uniform as the transmitted light of LCDP can be obtained. Therefore, the uneven light source is irradiated at LCDP, and if the signal which negates the heterogeneity of the light source to LCDP, and a video signal are impressed in piles, the image of uniform brightness will be reproduced.
[0016] The above-mentioned explanation is the fundamental principle of this invention. The technical problem which should be solved further occurs in practical use. Those technical problems and solution means will be expressed below, and various kinds of modifications for raising the function and an application will be explained as other examples.
[0017] The 1st technical problem is the relation between a signal level and the light transmittance of LCDP. This relation is not proportionally [straight-line] as known as a gamma property. It approximates that a signal level and light transmittance are proportionally [straight-line] first, the effectiveness of the brightness unevenness amendment by the theoretic configuration is explained, and an effective improvement means to cope with the fault produced with a gamma property next and it is explained.
[0018] Drawing 7 A is drawing showing the signal pair brightness property of LCDP approximated as a signal level and light transmittance are proportionally [straight-line]. An axis of abscissa expresses the level of the input signal on the basis of the common electrode of LCDP, and an axis of ordinate expresses the relative brightness of a screen. This LCDP is the so-called no MARI White type with which permeability serves as max, when an input signal is 0 level. Therefore, an input signal is a signal of the negative polarity which makes a points of drawing black level. Continuous-line a-b of drawing is the signal pair brightness property of the part of the average luminance of a screen, and broken-line a-c is the signal pair brightness property of a part darker than an average. Suppose that the signal as shows a wave now to the 4th quadrant of drawing as a continuous line for convenience was inputted. The brightness of d peaks of an input signal is shown by the part of the average luminance of a screen by e on continuous-line a-b, and is shown by the part darker than an average by f on broken-line a-c in it. So, in a part darker than the average of a screen, when signal level is made to increase and it is made for a peak to become g points, the brightness on a screen comes to be shown by h on broken-line a-c, appearance top brightness becomes equal to e on continuous-line a-b, and brightness unevenness is amended. Whenever this relation has the fixed ratio of a-d and a-g, it will be materialized on straight-line a-b and a-c.
[0019] Drawing 7 B draws the case where a signal level and light transmittance are not proportionally [straight-line], like this drawing A. an input signal — level — a-d — it is — a case — an average — being bright — a part — signal level — a-g — carrying out — if — said — drawing — A — the same — brightness — unevenness — amending — having — although — having differed — signal level — for example, — an input level — a-d — ' — ** — carrying out — if — amendment — level — a-g — ' — becoming — (a-g) — /— (a-d) — the same — a ratio — having — a-g — ' — it is not — things — understanding . Moreover, unlike the case of drawing A, brightness is slightly different, and the difference of the brightness of this point cannot amend it, either, even if the brightness in the black level of an input signal also changes signal amplitude.
[0020] Drawing 8 A is an example which has improved the amendment error when said signal level of the image amendment section 2 of this invention based on drawing 4 is large. The same function as drawing 4 attaches the same number, and explanation is omitted. Input video-signal 3a is inputted into a level converter 31 while it is inputted into a variable gain amplifier 15. The output of a level converter 31 is applied to the auxiliary control circuit 32 prepared between the control terminals and the outputs of D/A converter 18 which control the gain of a variable gain amplifier 15. The continuous line of drawing 8 B is what showed the input output characteristics of a level converter 18, an axis of abscissa expresses input signal level, and an axis of ordinate expresses the relative level of an output signal. This property is set as the input signal pair relative transmittance property and inverse number relation of LCDP which are shown with this drawing broken line. When you take the inverse number, generally let standard white-signal level be reference level. By carrying out like this, when input signal level is small, the amount of amendments is decreased, when input signal level is large, the amount of amendments is made to increase and an amendment error can be lessened. Although the polarity of one direction has shown drawing 8 B, it is natural in a bright place and a dark place compared with average brightness. [of the sense of amendment differing] Although the usual D/A converter outputs one polar electrical potential difference to input data, if it prepares independently an electrical potential difference equal near the middle point of the output range of a D/A converter as reference voltage and an auxiliary control circuit is made into a differential format, it can control positive/negative both directions easily.

[0021] Drawing 9 A shows the example which improves the amendment error near black level among previous technical problems based on drawing 4 . Input video-signal 3a is inputted into a level detector 33 while it is inputted into a variable gain amplifier 15. The output of a variable gain amplifier 15 is outputted after passing through the direct-current-level control circuit 34 continuously. The output of D/A converter 18 is inputted into the control terminal of the direct-current-level control circuit 34 through the auxiliary control circuit 35 while it is inputted into the gain control terminal of a variable gain amplifier.
[0022] As for the auxiliary control circuit 35, the direct-current transfer characteristics are controlled by the output of a level detector 33. Drawing 9 B shows the output characteristics to the video signal of a level detector 33. This property is what took the inverse number of the electrical-potential-difference pair permeability property near the black level of LCDP, and is adjusted according to the property of LCDP. If the control voltage pair output characteristics of the auxiliary control circuit 35 ****** level control electronics 34 are carried out proportionally [straight-line], according to input signal level, the black level of the output video signal of the direct-current-level control circuit 34 will change to drawing 9 B in a similar property. If the auxiliary control circuit 35 is made into a differential format like the example of drawing 8 , in a part with the average brightness of a screen, the direct-current-level control circuit 34 will not have substantial effect on a signal. In a different part from average brightness, even in an output, when input signal level of ** is large, the transfer characteristics of the auxiliary control circuit 35 are oppressed by the output from a level detector 33, and as for the direct-current-level control circuit 34, the control voltage according to the amendment data from D/A converter 18 does not have substantial effect on a signal too. When input signal level is small, a detection output occurs from a level detector 33, the transfer characteristics of the auxiliary control circuit 35 are energized by it, and the direct-current-level control circuit 34 comes to have substantial effect on a signal by it.
[0023] Drawing 10 is the example which improved the amendment error the large time of combination and signal level, and when [both] small for the system of drawing 8 and drawing 9 . By the explanation above-mentioned [actuation of a circuit], since it is clear, explanation is omitted. Moreover, the example explained above is fundamental, and in addition to this, although various combination and deformation of a control curve are possible, as long as it amends to said gamma curve, it does not deviate from the main point of this invention.
the 2nd technical problem comes out about the capacity of the memory for memorizing amendment data.
[0024] Since [a previous example] 8-bit data are used about one pixel, on the whole screen, 320x240x8=614400 bit memory is needed. Although the cost of semiconductor memory is reduced every year, when it is going to deal with a video signal on real time like the application of this invention, the thing of the high speed of that speed of operation is needed, there is a problem that power consumption also becomes large, and little way of the capacity of necessary memory is good. An example of a means which decreases memory space is shown and explained to drawing 11 .
[0025] Drawing 11 A is the amendment curve of Rhine with LCDP calculated like drawing 6 C. Before memorizing in memory, this data is approximated with the polygonal line below a fixed value with the rate of change of an inclination, as shown in this drawing B, and the X coordinate of the start point of each polygonal line and the inclination of the polygonal line are called for. amendment between the pixels which actuation of asking for this inclination is calculating the differential value of an amendment curve, and specifically adjoin a certain pixel — it asks easily by searching for the difference of counting. Moreover, what is necessary is to extract only the point which becomes more than constant value with a differential value, in order to approximate as the polygonal line.
[0026] Drawing 11 C is an example of the format memorized in memory. Data are treated per 1 byte (8 bits) also in this example. It precedes with all data and data $FF which shows that it is the beginning of Rhine is placed. Then, the numeric value G0 showing the correction factor of the beginning of each Rhine, the numeric value R1 which shows the inclination of an amendment curve, and the period N1 (it corresponds to a pixel number) which the same inclination continues are kept, and the following R2, N2, R3, and N3, it is repeated until the data of an inclination and a period become a pair to — and the data for one line are completed. The sum total of the data N1 and N2 for one line and the data of — is set to 320. Although the data of an inclination and the number of pixels are data of 8-bit arbitration, it is made not to use the data of $FF in this example, so that it may be distinguished from the beginning of Rhine. The number of pixels of one line is 320, and when it cannot express with 8 bits, it is divided into 2 times. For example, when a certain Rhine does not need amendment at all, the data for one line are as follows.
[0027]
$FF,$00,$00,$FE,$00,$42($FF+$42=$140;320)
The first $FF shows the beginning of Rhine. Unlike the example which sets up the gain of a variable gain amplifier 15 and was described first a little, the 2nd data show the deflection from standard gain. When it

expresses deflection, the sign which shows whether it is larger than a certified value or small is required. Then, 7 bits of low order are used as a numeric value of data, and the most significant bit performs forward or a negative judgment by 0 or 1. A 7-bit thing can be used for D/A converter 18 of the image amendment section by this approach. since $00 in the case of this example do not need amendment — standard gain — you may remain as it is -- things are shown. Moreover, in this example, the result is the same also as $80 as data. The 3rd data show an inclination. A sign for correction value to show an increment or reduction is required also about inclination, and it specifies by the same approach as gain deflection. The 4th data show the period which the same inclination continues as stated above. In this example, it inclines and the thing whose 0 is 254 pixels and to continue during the period is meant. The 5 or 6th data also show an inclination and data, and the thing whose inclination 0 is 66 pixels and to continue during the period is shown. Therefore, if the 3-6th data are set, this Rhine inclines and shows that it is the period whose inclination of 0 is 320 pixels, i.e., the regularity during the whole term.

[0028] Generally a phenomenon like brightness unevenness has many conditions that the brightness of the display screen is changing gently. Therefore, if the number of the point of inflection of an amendment curve can restrict to about ten points about one line, the drastic reduction of memory space of it will be attained. When it restricts to ten points temporarily, the number of the maximum data of one line becomes 2+10x2=22 byte, on the whole screen, is 240x22=5280 byte, i.e., 42240 bits, and can be sharply reduced compared with the previous example of count. It performs it as follows to actually restrict a data point, for example.

[0029] As first asked by drawing 11 B about one line of arbitration, it asks for the inclination between pixels, and the point that the rate that each inclination changes is bigger than a certain threshold set up beforehand is extracted. With [the number of the extracted points] ten [or less], memory is made to memorize as the ** data. With ten [or more] (when ten points are exceeded), when the number of the points of having repeated and extracted actuation of having enlarged slightly the threshold set up previously and extracting point of inflection becomes ten or less, it ends. Next Rhine extracts by returning to the first threshold again. When performing this actuation, a controller 30 has the buffer memory which can hold the data for one line, and takes data for every Rhine of the arbitration of LCDP.

[0030] Although the trial calculation of memory size was made in the above-mentioned example, having used all Rhine as ten points, all Rhine does not need the amendment which is ten points. Usually, since the capacity of memory is decided in the size of the n-th power of 2, it can also improve the use effectiveness of memory by optimizing the point size per line according to the memory to be used. In this case, the controller 30 needs to have a buffer holding the data for one screen. as a concrete example — 32 -- K bits is the 15th power of 2, i.e., 32768 bits = 4096 bytes, correctly. Since 2 bytes per line of Rhine information is required, 480 bytes per screen are deducted, and since 2 bytes of intermediary is used for the data of one point, 1808 points and 7.5 points per line are assigned to the data of point of inflection. Since a decimal cannot be used for the number of data, it turns into it per [7] line or with eight points. Then, the required point size for which it asked for every Rhine like drawing 11 B first is totaled about the whole screen, and it investigates how [whose total number of data is 1808 or less points] it is. When settled, satisfactory, it writes in memory as amendment data as it is, and initial setting is finished. If it divides by the number of Rhine which needs the data which exceed eight points for the number of the data which are not settled when not settled, it will be computed how many data should be decreased per line. Based on the result, when the number of reduction per line is large about Rhine exceeding eight points, a previous threshold is changed a little a lot, and it is point-of-inflection re-********. Conversely, the amount which exceeds a threshold when small is lessened slightly, and it is point-of-inflection re-********. It writes in memory as final amendment data in the place where this actuation was repeated at and the whole number of data was settled in less than 1808 points, and initial setting is ended. Since the number of pixels of one more line was decided by LCDP, the approach of omitting the data of the number of pixels continued to the data of the inclination of the last point of inflection is also possible for it. However, the circuit of the image amendment section becomes a little complicated in exchange for memory space in this case.

[0031] Although the data which the format of the data of drawing 11 C shows vertical positional information are not contained, it can know easily data of how many lines of LCDP since, as for the signal of television, it is decided on the basis of the Vertical Synchronizing signal that it scans from a top to the bottom perpendicularly, if the number of $FFs of a data stream is counted, it will be. Although the data format which follows $FF although it is natural may be changed and the number of direct Rhine may be directed, since all Rhine cannot be directed in 8 bits when making it a non-interlaced method, the device of making it a 2-byte configuration is needed. Moreover, although $FF was used as data in which the beginning of Rhine is shown, it is not limited to this. Other data can be used depending on the approach of a display of numeric data. For example, when amendment data $00 and $80 remove a sign also in this example, since those [both] without amendment are meant, as numeric data, either $00 or $80 do not need to use, and it is good also considering $00 as the

beginning of Rhine. Moreover, as contents of amendment data, other formats are variously possible. For example, although the whole amendment curve was specified by the data of the pair of the inclination of an amendment curve, and a duration in the above-mentioned example after specifying the standard gain of each Rhine, the method of assignment called the deflection of the gain in a duration and the following point may be used, and you may specify with the rate of change of a duration and an inclination.

[0032] Although the above example means reduction of the capacity of memory preferentially, and memory is needed to some extent from still more nearly another view, the method of putting emphasis on the direction which decreases a circuit scale is also possible. Although the example of drawing 11 specified a location and amendment data as data using 8 bits, if the approach of fixing positional information to the address of memory and displaying data only by 1 bit is adopted as stated by the theoretic approach, since it ends with 1 bit, a D/A converter can simplify a circuit. The number of pixels of LCDP, for example, about [twice as many as this / of 320x240] 154K bit, is required for the amount of data. A 1-bit conversion method is explained briefly. The D/A converter of a 1-bit conversion method consists of integrators which switch the output of amphipathy, when input data is 1, output voltage increases, and when input data is 0, it is constituted so that it may decrease. What is necessary is just to input 1 and 0 by turns as data to hold an output to constant value. If a conversion rate is gathered, two or more bits are assigned to 1 pixel or a fixed number of data of 1 follow it in order to correspond to a rapid change of correction value, the device of gathering the rate of change of an output is required. If data are switched using two or more high-speed buffers using the memory of a cutting tool configuration as memory for gathering a conversion rate, the memory itself does not need to be a high-speed thing specially. Moreover, when you need many amendments from the beginning of Rhine, it can set an output level as a necessary value at the timing which will actually be displayed on LCDP if a preamble period is prepared in amendment data and D/A conversion is started at a horizontal blanking interval, since flattery nature is bad.

[0033] As mentioned above, although the example was explained by making the liquid crystal television of monochrome form into an example, dealing with a color method is easy by establishing two or more signal conditioning means. generally, in the case of a color method, brightness unevenness originates in the light source, the effect is uniform about each primary color, and there is also nothing — although — although many, if it can respond by changing a primary multiplier in approximation and enables it to adjust the control sensibility of two or more signal conditioning means a little, it is not necessary to form memory and a D/A converter for each channel of every however, in such a case, since it usually comes out that the irregular color resulting from a panel does not have correlation for every channel and there is, in order to change a correction factor for every channel of each primary color, it is necessary to also form two or more memory and D/A converters

[0034] Moreover, it cannot be overemphasized that the application of this invention is not restricted to a liquid crystal television set. For example, it considers as the compensator for sending the special image effectiveness, for example, soft effectiveness can be given to masking of the partial image of a complicated configuration, or it can apply to it at fade-in/out. In this case, it is also possible by forming memory and a D/A converter independently for every color channel according to an application to direct the special effectiveness by the color. Moreover, this equipment is easy to be able to make it a removable configuration easily and to make it attach only in equipment to be amended to an image display device.

[0035] As mentioned above, according to this invention, the brightness unevenness generated according to a mechanical cause can be amended electrically. Since it can change comparatively easily, it can respond also to modification of the size of a light source lamp or a panel flexibly, and it becomes possible to amend for every one image display device also on the problem of the panel itself, and an electric signal can offer the image display device of uniform grace.

[0036]

[Effect of the Invention] As explained above, according to this invention, it is comparatively easy, and the image which had good homogeneity even if it used the heterogeneous light source can be reproduced. While in manufacturing an image display device avoiding the difficult problem for acquiring the expensive uniform light source and being able to respond to model modification flexibly The fall of the yield of a panel with the brightness unevenness which was not able to be used as a defective article can be relieved conventionally, and the compensator synthetically contributed to the manufacture cost reduction of a panel can be realized.

[Translation done.]

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TECHNICAL FIELD

[Industrial Application] This invention specifically sets compensation of partial degradation of the image by brightness unevenness, such as a liquid crystal panel (Following LCDP and brief sketch) currently used for the DEREBIJON receiving set etc., etc. as the main purposes about the amendment approach of the image information of an image display device, and equipment.

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PRIOR ART

[Description of the Prior Art] LCDP began to be used instead of the Braun tube with which the image display device used for the television receiver etc. in recent years has been used from the former. LCDP has the advantage that depth of a device can be made small compared with the Braun tube, and is leading equipment for image display. The characteristic point of LCDP is not emitting light oneself, and it is common knowledge that there are a light transmission form and a reflex as a display format. As a general application, the light source is established behind LCDP and the transparency form which controls the amount of transmitted lights by LCDP is used. In order to obtain the image of uniform brightness over the whole screen, it must be uniform, and this light source is made to deform the thickness of the lamp for the light sources, and the diffusion plate formed between LCDP(s) according to the location of a lamp, or elaborates the configuration of a reflecting plate established behind the lamp for the light sources, and the efforts for for acquiring the uniform light source are made.

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to this invention, the light source which is comparatively easy and is heterogeneous is used. While in being able to reproduce an image with homogeneity with good **, and manufacturing an image display device avoiding the difficult problem for acquiring the expensive uniform light source and being able to respond to model modification flexibly, the fall of the yield of a panel with the brightness unevenness which was not able to be used as a defective article can be relieved conventionally, and the compensator synthetically contributed to the manufacture cost reduction of a panel can be realized.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] It is one technical problem that the image display device using LCDP acquires the light source of uniform brightness over the whole screen on the structure. In order to acquire the light source of uniform brightness, this problem increases whenever [difficult] as spacing of a light source lamp and LCDP must be secured enough, and thin shape-ization of the display which is the advantage of LCDP cannot fully demonstrate that effectiveness, either, especially the size of a screen large-sized-izes. Moreover, since a diffusion plate and a reflecting plate have a light source lamp and a close relation, when it is going to change the class of lamp or is going to change a screen size, they are changed into coincidence and have the problem that ****** is not made as for flexible correspondence to ** and model modification. The problem on manufacture of the LCDP itself is also one of another causes of brightness unevenness further again. That is, the brightness of the display screen is determined with the permeability of LCDP, and this permeability is influenced by the thickness of the glass plate holding liquid crystal, and its spacing. In further for color displays, change of local transparency of a color filter is detected as brightness unevenness. Since a location changes with one-sheet one panels, in the Prior art, the brightness unevenness resulting from these LCDP(s) cannot cope with it, but is processed as a defective article, and has become the factor which reduces the yield of a panel as a result.
[0004] Then, the image which had good homogeneity even if the purpose of this invention was comparatively easy and it used the heterogeneous light source is reproducible. the difficult problem for acquiring the above-mentioned uniform light source in manufacturing an image display device — avoiding — model modification, while being able to respond flexibly The fall of the yield of a panel with the brightness unevenness which was not able to be used as a defective article is relieved conventionally, and it is in realizing the compensator synthetically contributed to the manufacture cost reduction of a panel.

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MEANS

[Means for Solving the Problem] The means for equalization carried out from the former was a means for making into homogeneity the light source which carries out incidence to LCDP. This invention avoids the various difficulties which are not the incident light of LCDP and are generated by the conventional approach by equalizing the transmitted light paying attention to the function of LCDP. That is, with a means to add the signal for amendment to the electrical signal supplied to LCDP in addition to the diffusion plate and reflecting plate which have been used from the former, if it sees as the whole image display device even if imperfect as the light source, the image of uniform brightness will be displayed.

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OPERATION

[Function] As for LCDP, the permeability changes with electric signals. Where the uniform light source is irradiated at LCDP, if a video signal is impressed to LCDP, the image according to a video signal will be observed as the transmitted light of LCDP. Conversely, if an electric signal is given so that the heterogeneity of the light source may be negated even if it irradiates the uneven light source at LCDP, brightness uniform as the transmitted light of LCDP can be obtained. Therefore, the uneven light source is irradiated at LCDP, and if the signal which negates the heterogeneity of the light source to LCDP, and a video signal are impressed in piles, the image of uniform brightness will be reproduced.

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EXAMPLE

[Example] Hereafter, the example of this invention is explained with reference to a drawing. The liquid crystal television of monochrome form where the usual television broadcasting of explanation is received as an image display device is made into the example for convenience.
[0008] Drawing 1 is the block diagram of the liquid crystal television of monochrome form which applied this invention. For simplification, all of an antenna required for the usual broadcast reception, channel selection equipment, a signal processor, etc. shall be contained in the receive section 1, and explanation is omitted. A video signal 3, a horizontal driving signal 4, a vertical driving signal 4, and a vertical driving signal 5 are supplied to the image display section 6 through the image amendment section 2 of this invention, respectively from a receive section 1. The suffix of b is attached and distinguished to the signal outputted to the signal inputted into the expedient upper image amendment section 2 of explanation in the suffix of a. The image display section 6 explains the conventional liquid crystal display and the unusual point briefly for an understanding of actuation of this invention, although there is nothing. Explanation of the principle of operation itself is omitted.
[0009] Drawing 2 is the detail block of the image display section 6. The liquid crystal panel 7 assumes the TFT active-matrix method of a spread form, and makes the vertical number of effective pixels level, and 320 and the thing which is 240, respectively. Therefore, in this example, the usual interlace is not performed but a screen is rewritten for every field. LCDP of drawing 2 is drawing customarily seen from the flesh side of the screen, and if it displays as a coordinate which makes the location of the pixel explained later, and the upper right of drawing a zero (0 0) (level, perpendicular), the lower left of drawing is expressed as (319,239). The X electrode 8 and the Y electrode 9 which drive each pixel are pulled out by the upper and lower sides and right and left at intervals of a pixel in order to mitigate the process tolerance of a panel. 2 sets of X drivers 10 and 11 which have 160 steps of shift registers respectively are connected to X electrode, and 120 steps of Y drivers 12 and 13 are respectively connected to Y electrode. A level clock, an auxiliary signal and a perpendicular clock, and an auxiliary signal are supplied to X and Y driver from a controller 14, respectively. The controller 14 has generated the horizontal and the perpendicular clock synchronizing with the horizontal and vertical driving signal which are supplied through the image amendment section 2. Supply is carried out for the video signal to X driver through the image amendment section 2. The sampling circuit is established in the video-signal input section of X driver (not shown), a video signal is sampled for every level clock period, and it transmits to the latter part one by one for every level clock period by the shift register, and is written in a panel all at once for every horizontal blanking interval. A vertical scan is controlled by the perpendicular clock supplied to Y driver from a controller 14, and a signal is impressed to the pixel electrode of the location where the electrode respectively driven with X driver and Y driver crosses. There is another common electrode (not shown) in LCDP, the permeability of liquid crystal changes according to the potential difference of a common electrode and a pixel electrode, and an image is displayed. The relation between the display position of a pixel and a television signal is determined uniquely as follows.
[0010] It is what was made to contrast the relation of a driving signal and a pixel horizontal [drawing 3] and vertical, and was drawn, and an axis of abscissa makes one period of a level clock correspond to 1 pixel, and shows 1 level period, and an axis of ordinate makes one period of a horizontal driving signal correspond to one line, and shows 1 perpendicular period. Since the number of pixels of the perpendicular direction of LCDP was set to 240, 90% (240/262.5) of private contracts of the signal of the 1 field is displayed on a screen. Supposing it displays 90% horizontally similarly, 356 will be chosen as an integer near 320/0.9, and 356 level clocks per 1 level period are needed. If count from the beginning of a vertical driving signal, and make the 20th horizontal scanning line into the 0th line of LCDP, it counts from the beginning of a horizontal driving signal horizontally in consideration of the bright-line blanking time before and after a horizontal and vertical driving signal, the 32nd clock is made into the 0th pixel and it counts at a line counter and a clock counter respectively, the location displayed on a screen can be directly directed with the value of a counter. However, in fact, since X and Y

driver are used by 2 sets, each driver is driven by turns at one half of the speed of the upper clock.
[0011] Drawing 4 is the theoretic block diagram of the image amendment section 2. After the video signal supplied from a receive section receives gain control with a variable gain amplifier 15, it is outputted. The gain of a variable gain amplifier 15 is controlled by the control voltage 19 from which the data 17 read from the nonvolatile memory 16 which has memorized the data corresponding to the gain which it is going to set up beforehand were changed by D/A converter 18. The value corresponding to an image display location is read by the horizontal driving signal 4 with which the data of memory 16 are supplied from the image amendment section 2, and the address control signal 21 generated by the controller 20 on the basis of a vertical driving signal 5. A horizontal driving signal 4 and a vertical driving signal 5 are supplied to the image display section 6 through the timing amendment circuit 22, respectively. Moreover, two or more data input terminals 23 and 24 for the below-mentioned initial setting are formed in memory 16 and D/A converter 18.
[0012] Although an address control signal is generated from a horizontal and a perpendicular signal by this example, it is easy to be the same as the horizontal of LCDP, and the value of a perpendicular counter fundamentally, and when a signal can be taken out from the horizontal and perpendicular counter of a panel, a circuit can be simplified sharply. The address of memory 16 can be expressed with the same notation as the location of the pixel explained by drawing 3 , and read-out is performed as it is with said Rhine and a clock counter value. Since the numbers of pixels of X and the direction of Y are 320 and 240, respectively, X can be expressed with 9 bits and Y can be expressed with the binary number of 8 bits. Suppose that the locations of a pixel are (285, 137) as an example. If the hexadecimal notation of 285 and 137 is carried out, since it is $11D and $89, the address of memory will be specified like $11D89, respectively. (Since a horizontal scanning period is expressed in television relation as H in many cases, in order to avoid derangement, a hexadecimal notation attaches and expresses $ also to the following explanation before a figure) .
[0013] The data of memory 16 are memorized for the numeric value of 1 byte (8 bits) about the one address. the min of 8-bit D/A converter 18 -- resolving power is 0.005V, and when the data of memory change from $00 to $FF, the control voltage of a variable gain amplifier 15 changes to 1.275V from 0V. The relation between the gain of a variable gain amplifier 15 and control voltage is set up proportionally [straight-line] by this example. When control voltage is 0V and gain 0 and control voltage are maxes, 1.275V [i.e.,], it is twice, and when control voltage is 0.64V (i.e., when the data of memory are $80), gain increases 1 time.
[0014] Next, the procedure which actually amends brightness unevenness is explained. Drawing 5 is the conceptual diagram of the equipment for initializing the image amendment section 2 of this invention. Initial setting is performed in the condition of having included in the TV except the receive section 1 of drawing 1 . In drawing, the light source lamp 25, the reflecting plate 26, and the diffusion plate 27 are assembled by LCDP6 at normal. Equipment required for initial setting is the collection lens 28 of light, an optical/electrical converter 29, and a controller 30, and although not shown in drawing, a condenser lens and an optical/electrical converter 29 are united, and are fixed to LCDP and a fixed location, and the whole is shaded so that the light from the outside may not leak to an optical/electrical converter 29. A controller 30 is equipped with the A/D converter which inputs the output signal from an optical/electrical converter 29, and is changed into a digital signal, outputs the signal for initial setting to the image amendment section 2, and can constitute it from a common personal computer easily while it outputs the horizontal and vertical driving signal which drive LCDP. If the fixed signal of halftone ready brightness is inputted as a video signal and the amount of transmitted lights of LCDP is sampled for every pixel with such a configuration, distribution of brightness unevenness as shown in drawing 6 A will be acquired. At this time, a control signal 24 is impressed to D/A converter 18 from the outside, and it is set up so that the gain of a variable gain amplifier 15 may be set to 1 regardless of the data read from memory 16. What 6 Fig. B made the axis of abscissa permeability about the one scanning line in the location of a pixel, and normalized the axis of ordinate on the basis of the average transmission coefficient of the whole screen is shown. As this normalization permeability becomes uniform on the whole screen, it amends brightness unevenness. That is, the part with low transmission enlarges luminance-signal level, and the part with high transmission makes luminance-signal level small. If a concrete numeric value shows, since it is not necessary to amend, gain is 1, amendment data are $80, and since permeability needs to lower 20% from an average, amendment data will become 80% of $80, $66 [i.e.,], in the place where permeability is equal to the average value of the whole screen. Drawing 6 C is an amendment curve obtained by taking the inverse number of the curve of B based on this idea. Although this example assumed the gain of a variable gain amplifier, and the relation of control voltage to be straight lines, realizing a perfect straight line in fact should just add amendment beforehand, when it is not necessary to make it a straight line that it is difficult and by force [again] and an amendment curve is calculated from the measured value of transmission. If the program is beforehand included in the controller, count of this amendment curve will be immediately called for at the same time it takes data. In this way, the obtained correction data are written in memory 16 through the data input line 23 from a controller,

and initial setting is ended.
[0015] As explained above, as for LCDP, according to this example, that permeability changes with electric signals. Where the uniform light source is irradiated at LCDP, if a video signal is impressed to LCDP, the image according to a video signal will be observed as the transmitted light of LCDP. Conversely, if an electric signal is given so that the heterogeneity of the light source may be negated even if it irradiates the uneven light source at LCDP, brightness uniform as the transmitted light of LCDP can be obtained. Therefore, the uneven light source is irradiated at LCDP, and if the signal which negates the heterogeneity of the light source to LCDP, and a video signal are impressed in piles, the image of uniform brightness will be reproduced.
[0016] The above-mentioned explanation is the fundamental principle of this invention. The technical problem which should be solved further occurs in practical use. Those technical problems and solution means will be expressed below, and various kinds of modifications for raising the function and an application will be explained as other examples.
[0017] The 1st technical problem is the relation between a signal level and the light transmittance of LCDP. This relation is not proportionally [straight-line] as known as a gamma property. It approximates that a signal level and light transmittance are proportionally [straight-line] first, the effectiveness of the brightness unevenness amendment by the theoretic configuration is explained, and an effective improvement means to cope with the fault produced with a gamma property next and it is explained.
[0018] Drawing 7 A is drawing showing the signal pair brightness property of LCDP approximated as a signal level and light transmittance are proportionally [straight-line]. An axis of abscissa expresses the level of the input signal on the basis of the common electrode of LCDP, and an axis of ordinate expresses the relative brightness of a screen. This LCDP is the so-called no MARI White type with which permeability serves as max, when an input signal is 0 level. Therefore, an input signal is a signal of the negative polarity which makes a points of drawing black level. Continuous-line a-b of drawing is the signal pair brightness property of the part of the average luminance of a screen, and broken-line a-c is the signal pair brightness property of a part darker than an average. Suppose that the signal as shows a wave now to the 4th quadrant of drawing as a continuous line for convenience was inputted. The brightness of d peaks of an input signal is shown by the part of the average luminance of a screen by e on continuous-line a-b, and is shown by the part darker than an average by f on broken-line a-c in it. So, in a part darker than the average of a screen, when signal level is made to increase and it is made for a peak to become g points, the brightness on a screen comes to be shown by h on broken-line a-c, appearance top brightness becomes equal to e on continuous-line a-b, and brightness unevenness is amended. Whenever this relation has the fixed ratio of a-d and a-g, it will be materialized on straight-line a-b and a-c.
[0019] Drawing 7 B draws the case where a signal level and light transmittance are not proportionally [straight-line], like this drawing A. an input signal — level -- a-d — it is -- a case -- an average -- being bright -- a part — signal level — a-g — carrying out -- if — said -- drawing -- A -- the same — brightness — unevenness -- amending -- having -- although — having differed — signal level — for example, — an input level — a-d — ' — ** — carrying out — if — amendment -- level — a-g — ' — becoming — (a-g) — /— (a-d) — the same — a ratio -- having — a-g — ' — it is not — things — understanding . Moreover, unlike the case of drawing A, brightness is slightly different, and the difference of the brightness of this point cannot amend it, either, even if the brightness in the black level of an input signal also changes signal amplitude.
[0020] Drawing 8 A is an example which has improved the amendment error when said signal level of the image amendment section 2 of this invention based on drawing 4 is large. The same function as drawing 4 attaches the same number, and explanation is omitted. Input video-signal 3a is inputted into a level converter 31 while it is inputted into a variable gain amplifier 15. The output of a level converter 31 is applied to the auxiliary control circuit 32 prepared between the control terminals and the outputs of D/A converter 18 which control the gain of a variable gain amplifier 15. The continuous line of drawing 8 B is what showed the input output characteristics of a level converter 18, an axis of abscissa expresses input signal level, and an axis of ordinate expresses the relative level of an output signal. This property is set as the input signal pair relative transmittance property and inverse number relation of LCDP which are shown with this drawing broken line. When you take the inverse number, generally let standard white-signal level be reference level. By carrying out like this, when input signal level is small, the amount of amendments is decreased, when input signal level is large, the amount of amendments is made to increase and an amendment error can be lessened. Although the polarity of one direction has shown drawing 8 B, it is natural in a bright place and a dark place compared with average brightness. [of the sense of amendment differing] Although the usual D/A converter outputs one polar electrical potential difference to input data, if it prepares independently an electrical potential difference equal near the middle point of the output range of a D/A converter as reference voltage and an auxiliary control circuit is made into a differential format, it can control positive/negative both directions easily.

[0021] Drawing 9 A shows the example which improves the amendment error near black level among previous technical problems based on drawing 4 . Input video-signal 3a is inputted into a level detector 33 while it is inputted into a variable gain amplifier 15. The output of a variable gain amplifier 15 is outputted after passing through the direct-current-level control circuit 34 continuously. The output of D/A converter 18 is inputted into the control terminal of the direct-current-level control circuit 34 through the auxiliary control circuit 35 while it is inputted into the gain control terminal of a variable gain amplifier.
[0022] As for the auxiliary control circuit 35, the direct-current transfer characteristics are controlled by the output of a level detector 33. Drawing 9 B shows the output characteristics to the video signal of a level detector 33. This property is what took the inverse number of the electrical-potential-difference pair permeability property near the black level of LCDP, and is adjusted according to the property of LCDP. If the control voltage pair output characteristics of the auxiliary control circuit 35 ****** level control electronics 34 are carried out proportionally [straight-line], according to input signal level, the black level of the output video signal of the direct-current-level control circuit 34 will change to drawing 9 B in a similar property. If the auxiliary control circuit 35 is made into a differential format like the example of drawing 8 , in a part with the average brightness of a screen, the direct-current-level control circuit 34 will not have substantial effect on a signal. In a different part from average brightness, even in an output, when input signal level of ** is large, the transfer characteristics of the auxiliary control circuit 35 are oppressed by the output from a level detector 33, and as for the direct-current-level control circuit 34, the control voltage according to the amendment data from D/A converter 18 does not have substantial effect on a signal too. When input signal level is small, a detection output occurs from a level detector 33, the transfer characteristics of the auxiliary control circuit 35 are energized by it, and the direct-current-level control circuit 34 comes to have substantial effect on a signal by it.
[0023] Drawing 10 is the example which improved the amendment error the large time of combination and signal level, and when [both] small for the system of drawing 8 and drawing 9 . By the explanation above-mentioned [actuation of a circuit], since it is clear, explanation is omitted. Moreover, the example explained above is fundamental, and in addition to this, although various combination and deformation of a control curve are possible, as long as it amends to said gamma curve, it does not deviate from the main point of this invention. the 2nd technical problem comes out about the capacity of the memory for memorizing amendment data.
[0024] Since [a previous example] 8-bit data are used about one pixel, on the whole screen, 320x240x8=614400 bit memory is needed. Although the cost of semiconductor memory is reduced every year, when it is going to deal with a video signal on real time like the application of this invention, the thing of the high speed of that speed of operation is needed, there is a problem that power consumption also becomes large, and little way of the capacity of necessary memory is good. An example of a means which decreases memory space is shown and explained to drawing 11 .
[0025] Drawing 11 A is the amendment curve of Rhine with LCDP calculated like drawing 6 C. Before memorizing in memory, this data is approximated with the polygonal line below a fixed value with the rate of change of an inclination, as shown in this drawing B, and the X coordinate of the start point of each polygonal line and the inclination of the polygonal line are called for. amendment between the pixels which actuation of asking for this inclination is calculating the differential value of an amendment curve, and specifically adjoin a certain pixel -- it asks easily by searching for the difference of counting. Moreover, what is necessary is to extract only the point which becomes more than constant value with a differential value, in order to approximate as the polygonal line.
[0026] Drawing 11 C is an example of the format memorized in memory. Data are treated per 1 byte (8 bits) also in this example. It precedes with all data and data $FF which shows that it is the beginning of Rhine is placed. Then, the numeric value G0 showing the correction factor of the beginning of each Rhine, the numeric value R1 which shows the inclination of an amendment curve, and the period N1 (it corresponds to a pixel number) which the same inclination continues are kept, and the following R2, N2, R3, and N3, it is repeated until the data of an inclination and a period become a pair to -- and the data for one line are completed. The sum total of the data N1 and N2 for one line and the data of -- is set to 320. Although the data of an inclination and the number of pixels are data of 8-bit arbitration, it is made not to use the data of $FF in this example, so that it may be distinguished from the beginning of Rhine. The number of pixels of one line is 320, and when it cannot express with 8 bits, it is divided into 2 times. For example, when a certain Rhine does not need amendment at all, the data for one line are as follows.
[0027]
$FF,$00,$00,$FE,$00,$42($FF+$42=$140;320)
The first $FF shows the beginning of Rhine. Unlike the example which sets up the gain of a variable gain amplifier 15 and was described first a little, the 2nd data show the deflection from standard gain. When it

expresses deflection, the sign which shows whether it is larger than a certified value or small is required. Then, 7 bits of low order are used as a numeric value of data, and the most significant bit performs forward or a negative judgment by 0 or 1. A 7-bit thing can be used for D/A converter 18 of the image amendment section by this approach. since $00 in the case of this example do not need amendment -- standard gain -- you may remain as it is -- things are shown. Moreover, in this example, the result is the same also as $80 as data. The 3rd data show an inclination. A sign for correction value to show an increment or reduction is required also about inclination, and it specifies by the same approach as gain deflection. The 4th data show the period which the same inclination continues as stated above. In this example, it inclines and the thing whose 0 is 254 pixels and to continue during the period is meant. The 5 or 6th data also show an inclination and data, and the thing whose inclination 0 is 66 pixels and to continue during the period is shown. Therefore, if the 3-6th data are set, this Rhine inclines and shows that it is the period whose inclination of 0 is 320 pixels, i.e., the regularity during the whole term.

[0028] Generally a phenomenon like brightness unevenness has many conditions that the brightness of the display screen is changing gently. Therefore, if the number of the point of inflection of an amendment curve can restrict to about ten points about one line, the drastic reduction of memory space of it will be attained. When it restricts to ten points temporarily, the number of the maximum data of one line becomes 2+10x2=22 byte, on the whole screen, is 240x22=5280 byte, i.e., 42240 bits, and can be sharply reduced compared with the previous example of count. It performs it as follows to actually restrict a data point, for example.

[0029] As first asked by drawing 11 B about one line of arbitration, it asks for the inclination between pixels, and the point that the rate that each inclination changes is bigger than a certain threshold set up beforehand is extracted. With [the number of the extracted points] ten [or less], memory is made to memorize as the ** data. With ten [or more] (when ten points are exceeded), when the number of the points of having repeated and extracted actuation of having enlarged slightly the threshold set up previously and extracting point of inflection becomes ten or less, it ends. Next Rhine extracts by returning to the first threshold again. When performing this actuation, a controller 30 has the buffer memory which can hold the data for one line, and takes data for every Rhine of the arbitration of LCDP.

[0030] Although the trial calculation of memory size was made in the above-mentioned example, having used all Rhine as ten points, all Rhine does not need the amendment which is ten points. Usually, since the capacity of memory is decided in the size of the n-th power of 2, it can also improve the use effectiveness of memory by optimizing the point size per line according to the memory to be used. In this case, the controller 30 needs to have a buffer holding the data for one screen. as a concrete example -- 32 -- K bits is the 15th power of 2, i.e., 32768 bits = 4096 bytes, correctly. Since 2 bytes per line of Rhine information is required, 480 bytes per screen are deducted, and since 2 bytes of intermediary is used for the data of one point, 1808 points and 7.5 points per line are assigned to the data of point of inflection. Since a decimal cannot be used for the number of data, it turns into it per [7] line or with eight points. Then, the required point size for which it asked for every Rhine like drawing 11 B first is totaled about the whole screen, and it investigates how [whose total number of data is 1808 or less points] it is. When settled, satisfactory, it writes in memory as amendment data as it is, and initial setting is finished. If it divides by the number of Rhine which needs the data which exceed eight points for the number of the data which are not settled when not settled, it will be computed how many data should be decreased per line. Based on the result, when the number of reduction per line is large about Rhine exceeding eight points, a previous threshold is changed a little a lot, and it is point-of-inflection re-********. Conversely, the amount which exceeds a threshold when small is lessened slightly, and it is point-of-inflection re-********. It writes in memory as final amendment data in the place where this actuation was repeated at and the whole number of data was settled in less than 1808 points, and initial setting is ended. Since the number of pixels of one more line was decided by LCDP, the approach of omitting the data of the number of pixels continued to the data of the inclination of the last point of inflection is also possible for it. However, the circuit of the image amendment section becomes a little complicated in exchange for memory space in this case.

[0031] Although the data which the format of the data of drawing 11 C shows vertical positional information are not contained, it can know easily data of how many lines of LCDP since, as for the signal of television, it is decided on the basis of the Vertical Synchronizing signal that it scans from a top to the bottom perpendicularly, if the number of $FFs of a data stream is counted, it will be. Although the data format which follows $FF although it is natural may be changed and the number of direct Rhine may be directed, since all Rhine cannot be directed in 8 bits when making it a non-interlaced method, the device of making it a 2-byte configuration is needed. Moreover, although $FF was used as data in which the beginning of Rhine is shown, it is not limited to this. Other data can be used depending on the approach of a display of numeric data. For example, when amendment data $00 and $80 remove a sign also in this example, since those [both] without amendment are meant, as numeric data, either $00 or $80 do not need to use, and it is good also considering $00 as the

beginning of Rhine. Moreover, as contents of amendment data, other formats are variously possible. For example, although the whole amendment curve was specified by the data of the pair of the inclination of an amendment curve, and a duration in the above-mentioned example after specifying the standard gain of each Rhine, the method of assignment called the deflection of the gain in a duration and the following point may be used, and you may specify with the rate of change of a duration and an inclination.

[0032] Although the above example means reduction of the capacity of memory preferentially, and memory is needed to some extent from still more nearly another view, the method of putting emphasis on the direction which decreases a circuit scale is also possible. Although the example of drawing 11 specified a location and amendment data as data using 8 bits, if the approach of fixing positional information to the address of memory and displaying data only by 1 bit is adopted as stated by the theoretic approach, since it ends with 1 bit, a D/A converter can simplify a circuit. The number of pixels of LCDP, for example, about [twice as many as this / of 320x240] 154K bit, is required for the amount of data. A 1-bit conversion method is explained briefly. The D/A converter of a 1-bit conversion method consists of integrators which switch the output of amphipathy, when input data is 1, output voltage increases, and when input data is 0, it is constituted so that it may decrease. What is necessary is just to input 1 and 0 by turns as data to hold an output to constant value. If a conversion rate is gathered, two or more bits are assigned to 1 pixel or a fixed number of data of 1 follow it in order to correspond to a rapid change of correction value, the device of gathering the rate of change of an output is required. If data are switched using two or more high-speed buffers using the memory of a cutting tool configuration as memory for gathering a conversion rate, the memory itself does not need to be a high-speed thing specially. Moreover, when you need many amendments from the beginning of Rhine, it can set an output level as a necessary value at the timing which will actually be displayed on LCDP if a preamble period is prepared in amendment data and D/A conversion is started at a horizontal blanking interval, since flattery nature is bad.

[0033] As mentioned above, although the example was explained by making the liquid crystal television of monochrome form into an example, dealing with a color method is easy by establishing two or more signal conditioning means. generally, in the case of a color method, brightness unevenness originates in the light source, the effect is uniform about each primary color, and there is also nothing — although -- although many, if it can respond by changing a primary multiplier in approximation and enables it to adjust the control sensibility of two or more signal conditioning means a little, it is not necessary to form memory and a D/A converter for each channel of every however, in such a case, since it usually comes out that the irregular color resulting from a panel does not have correlation for every channel and there is, in order to change a correction factor for every channel of each primary color, it is necessary to also form two or more memory and D/A converters

[0034] Moreover, it cannot be overemphasized that the application of this invention is not restricted to a liquid crystal television set. For example, it considers as the compensator for sending the special image effectiveness, for example, soft effectiveness can be given to masking of the partial image of a complicated configuration, or it can apply to it at fade-in/out. In this case, it is also possible by forming memory and a D/A converter independently for every color channel according to an application to direct the special effectiveness by the color. Moreover, this equipment is easy to be able to make it a removable configuration easily and to make it attach only in equipment to be amended to an image display device.

[0035] As mentioned above, according to this invention, the brightness unevenness generated according to a mechanical cause can be amended electrically. Since it can change comparatively easily, it can respond also to modification of the size of a light source lamp or a panel flexibly, and it becomes possible to amend for every one image display device also on the problem of the panel itself, and an electric signal can offer the image display device of uniform grace.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram showing one example of this invention theoretically.
[Drawing 2] The explanatory view showing the image display section.
[Drawing 3] The explanatory view shown in order to explain the location of a pixel, and the relation of a video signal.
[Drawing 4] The block diagram showing the example of the image amendment section of drawing 1 .
[Drawing 5] Drawing showing the example of the equipment for creating amendment data.
[Drawing 6] The explanatory view shown in order to explain the transmission of LCDP, and the relation of amendment data.
[Drawing 7] Drawing shown in order to explain the permeability of LCDP, and the relation of a signal.
[Drawing 8] The block diagram showing other examples of the image amendment section.
[Drawing 9] The block diagram showing other examples of the image amendment section.
[Drawing 10] The block diagram showing the example of further others of the image amendment section.
[Drawing 11] Drawing shown in order to explain other formats of amendment data.
[Description of Notations]
1 [— Liquid crystal panel 15 (LCDP) / — A variable gain amplifier, 16 / -- Memory, 18 / -- A D/A converter, 20 / — A controller, 31 / — 32 A level converter, 35 / -- An auxiliary control circuit, 33 / — A level detector, 34 / — Direct-current-level control circuit.] -- A receive section, 2 -- The image amendment section, 6 — The image display section, 7

[Translation done.]

* NOTICES *

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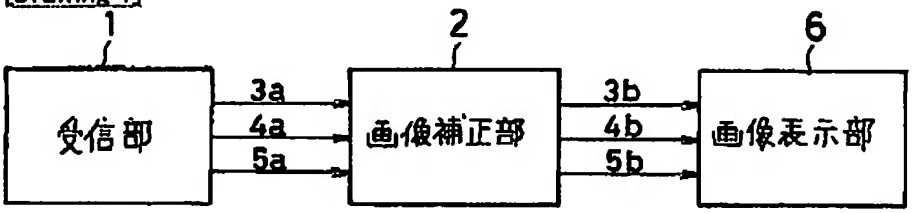
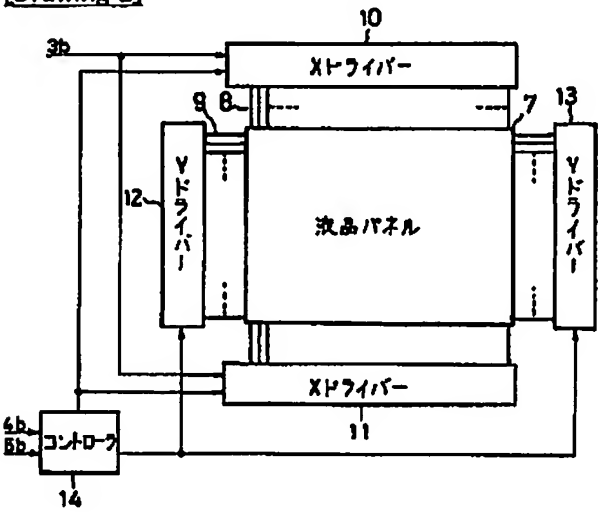
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Drawing 2]



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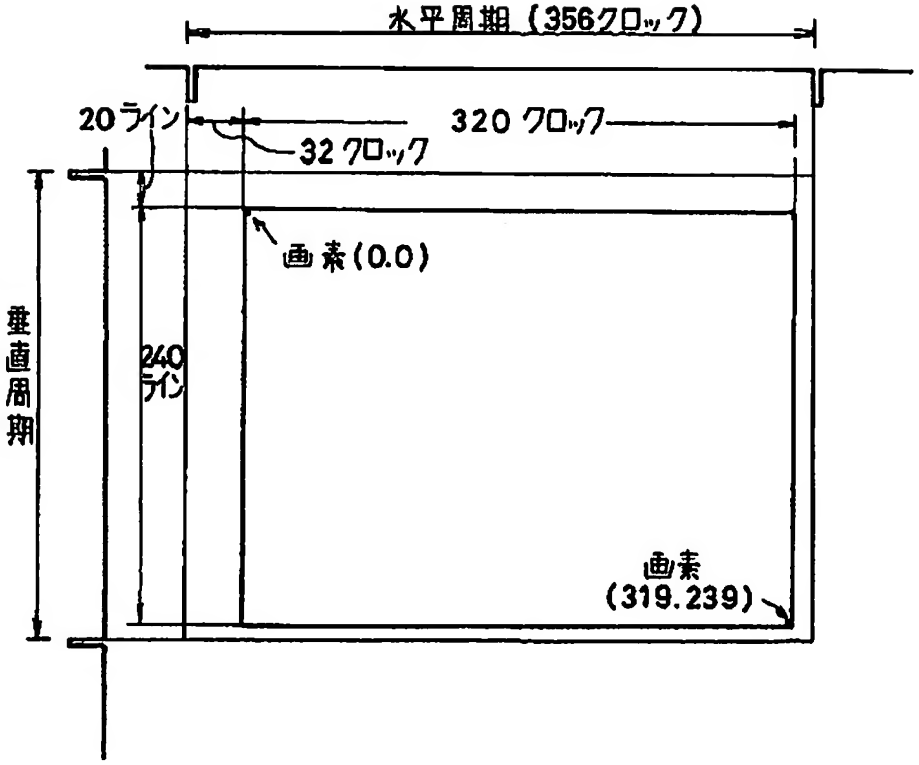
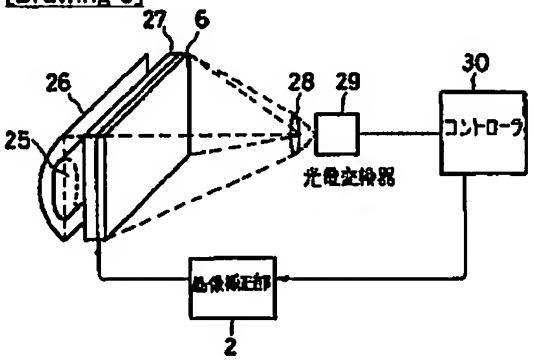
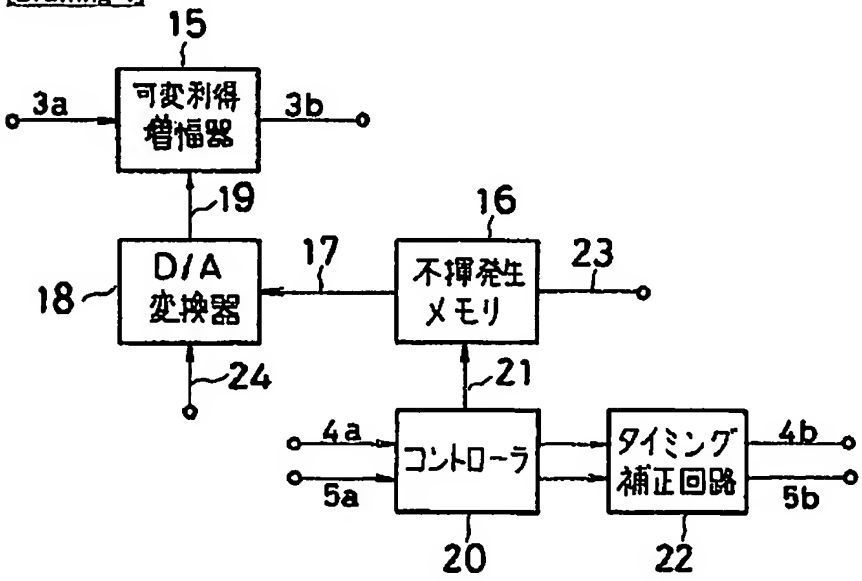


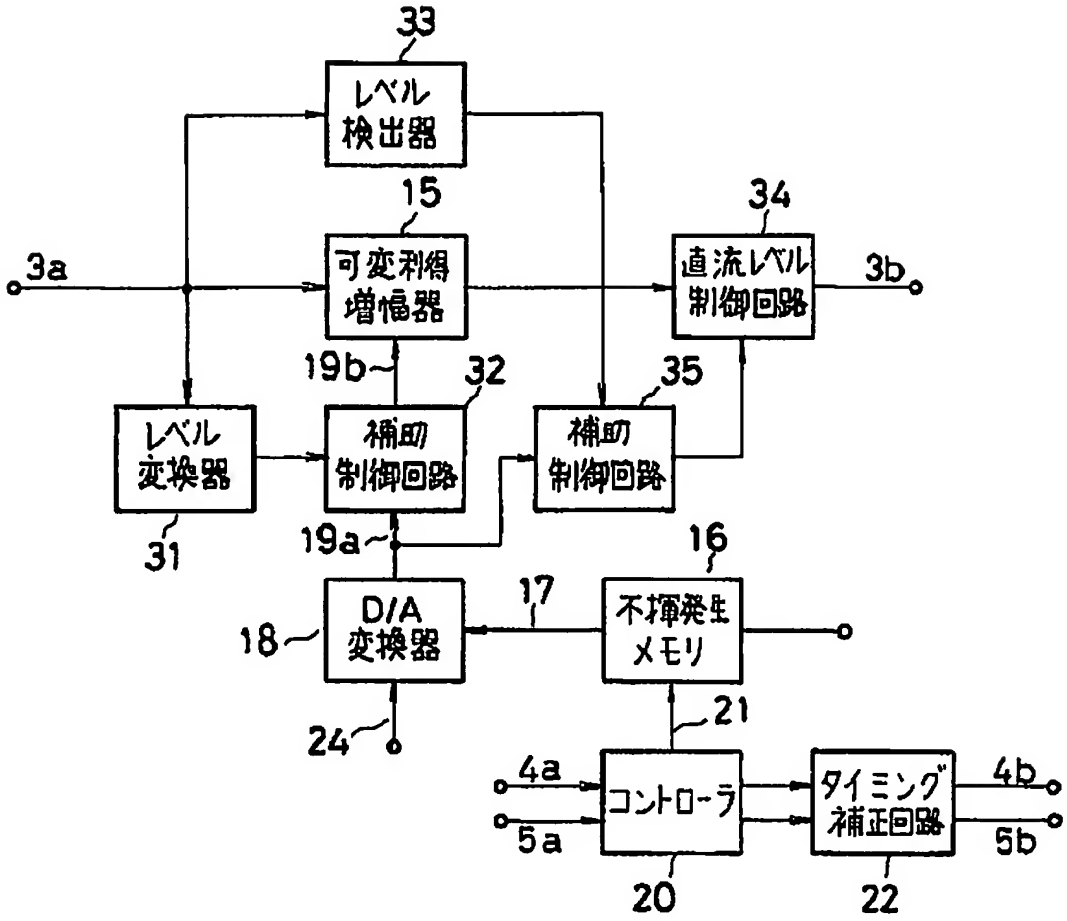
[Drawing 5]



[Drawing 4]

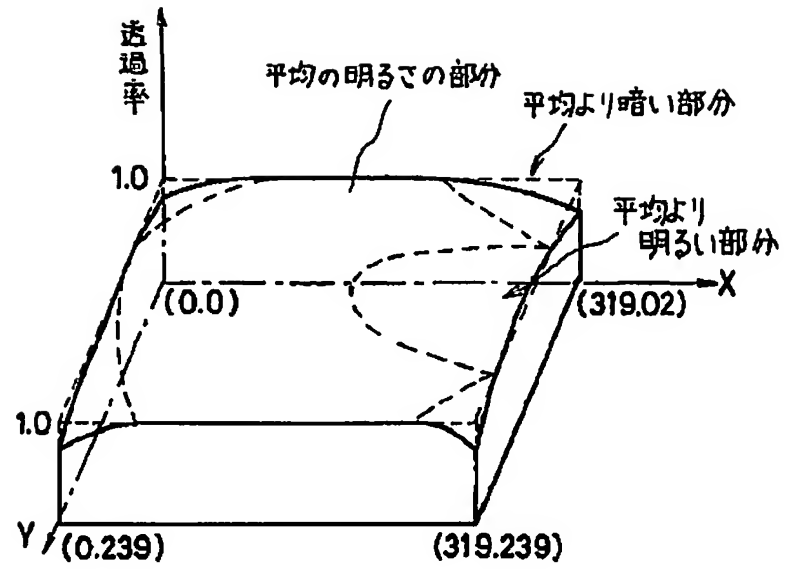


[Drawing 10]

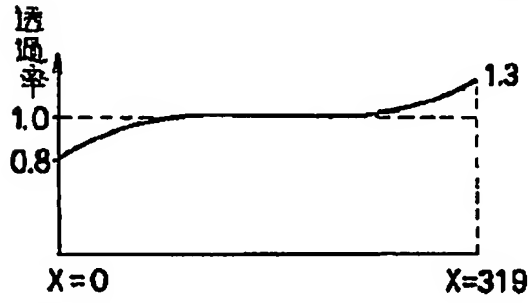

33
レベル検出器
15
34
3a
可変利得増幅器
直流レベル制御回路
3b
19b
32
35
レベル変換器
補助制御回路
補助制御回路
31
19a
16
D/A変換器
17
不揮発性メモリ
18
21
24
4a
コントローラ
タイミング補正回路
4b
5a
5b
20
22

[Drawing 6]

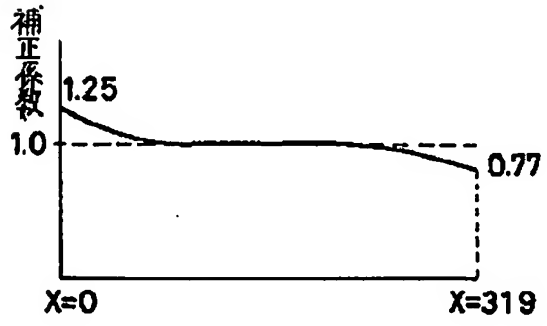
(A)



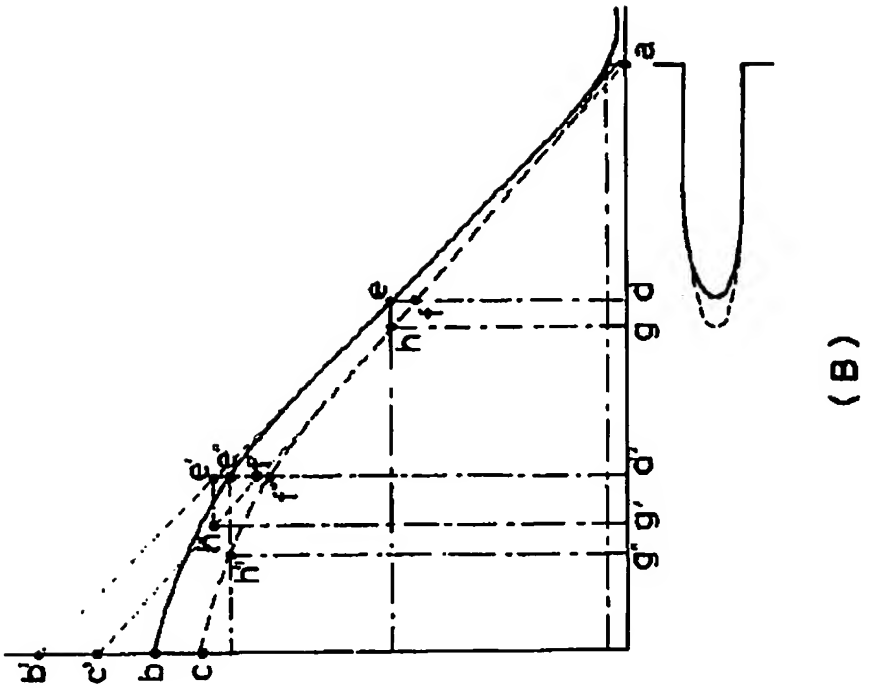
(B)



(C)



[Drawing 7]



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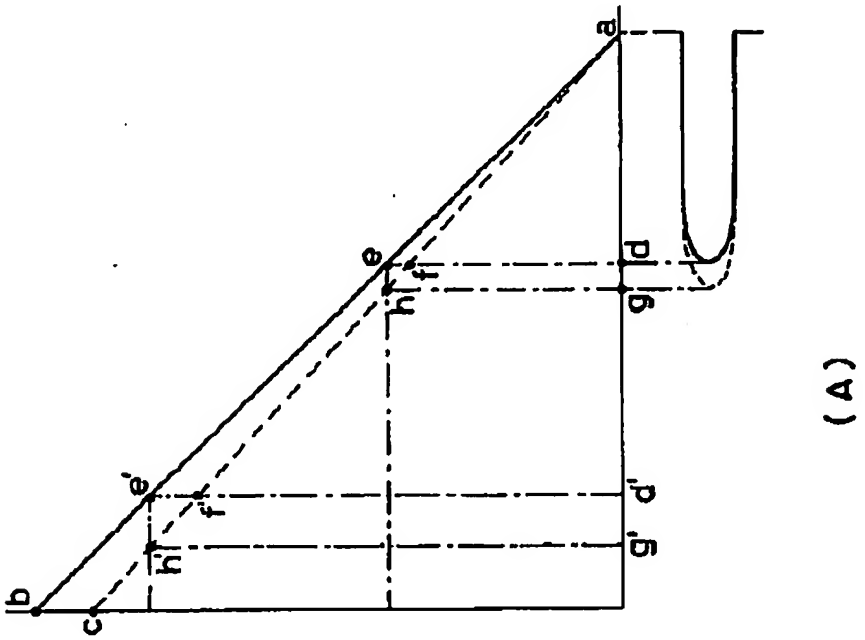
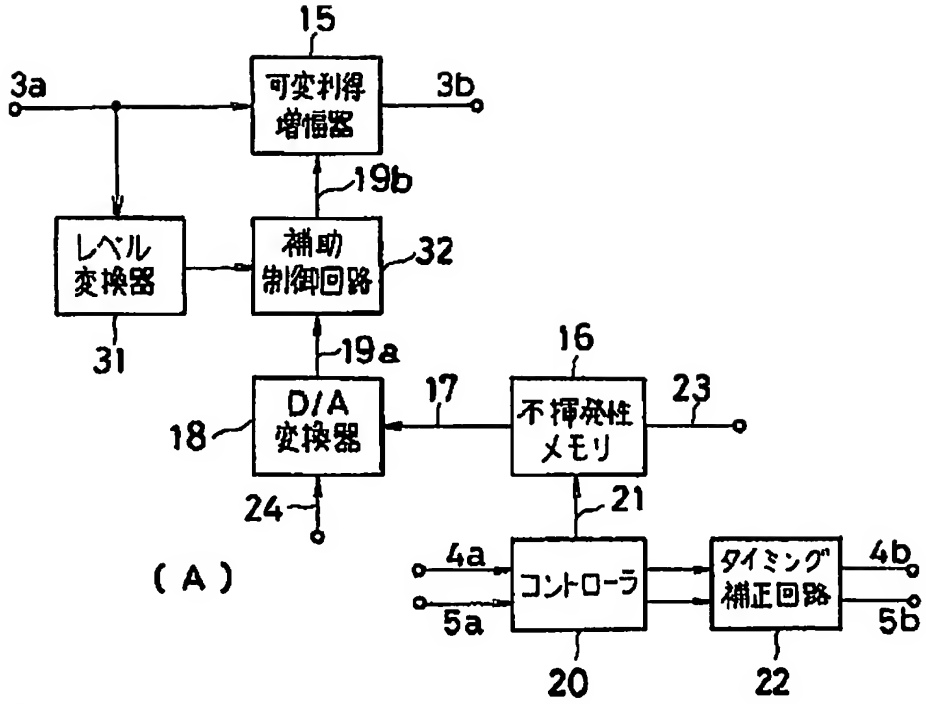
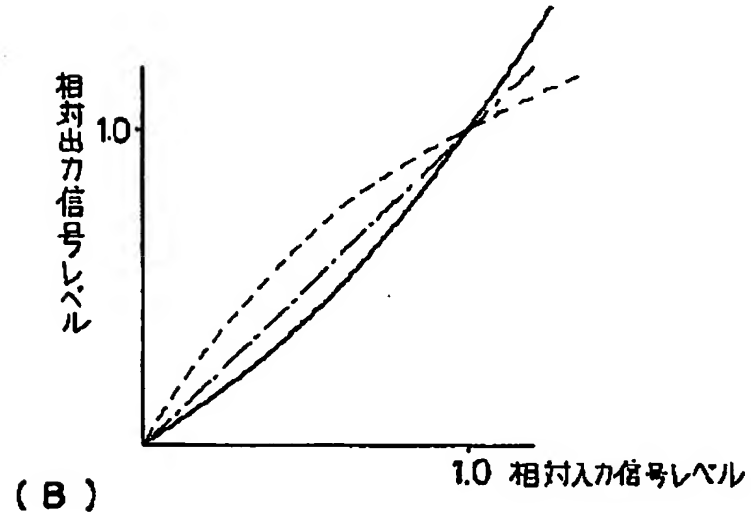


(A)

[Drawing 8]


15
3a
可変利得
増幅器
3b
19b
レベル
変換器
補助
制御回路
32
31
19a
16
D/A
変換器
17
不揮発性
メモリ
23
18
24
21
4a
コントローラ
タイミング
補正回路
4b
5a
5b
20
22

(A)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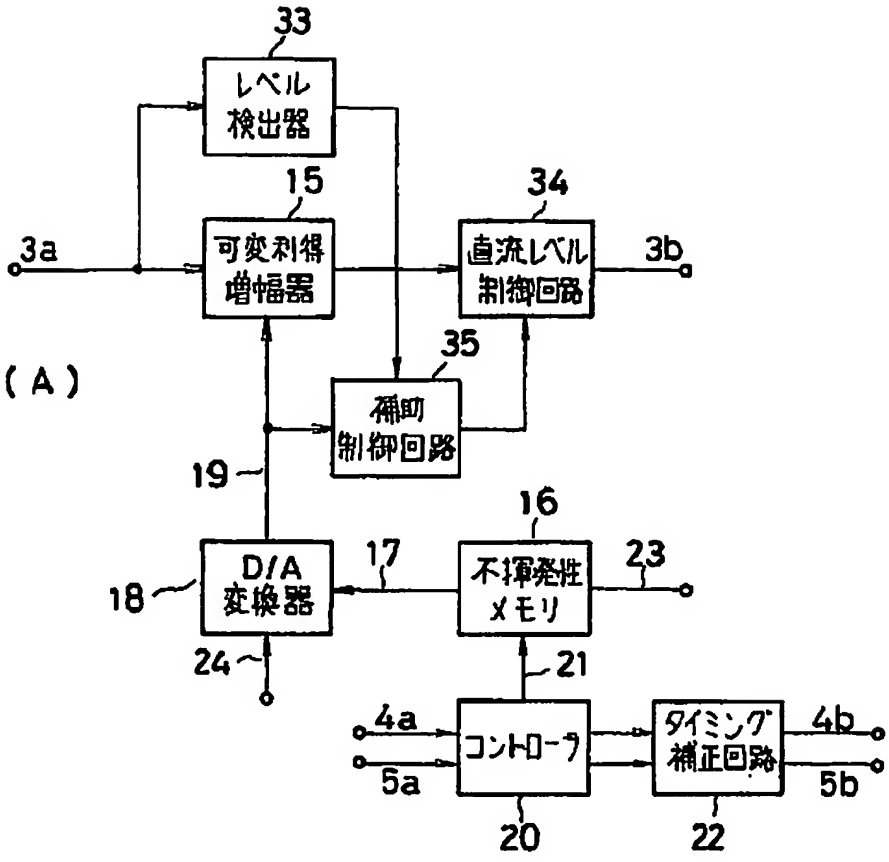
1.0
1.0 相対入力信号レベル

(B)

[Drawing 9]



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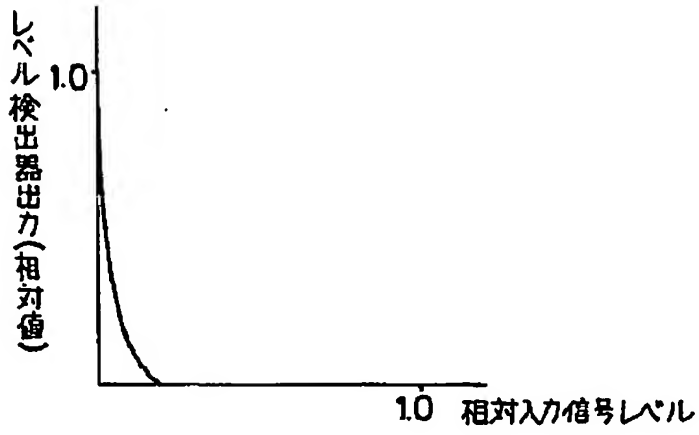
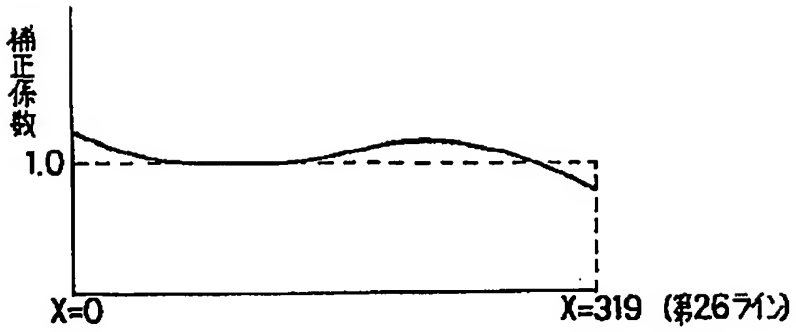


(B)

[Drawing 11]

(A)



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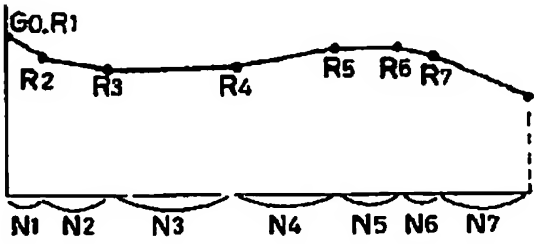

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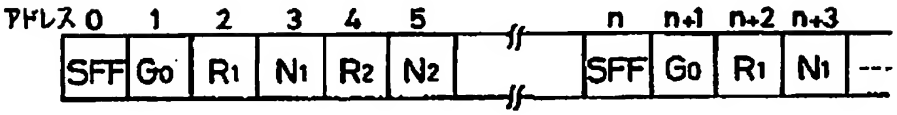

FFH	水平ラインの始まりを示すデータ
G0	水平ラインの始まりの点の補正値
R1	水平ラインの始まりの点の補正カーブの傾き
N1	同一傾きが継続する画素数
R2	次の折れ点の補正カーブの傾き
N2	同一傾きが継続する画素数
⋮	

[Translation done.]